A New VME-based Acquisition System for Gammasphere

M. Cromaz, R.M. Clark, M.A. Deleplanque, M. Descovich, R.M. Diamond,
P. Fallon, I.Y. Lee, A.O. Macchiavelli, H. Mahmud, F.S. Stevens, D. Ward
Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720

The primary functions of the Gammasphere VME-based acquisition system is to filter and format the raw data stream acquired from the VXI-based electronics and save the processed data to tape for subsequent analysis. The current system distributes these functions over 13 68040 based VME (VERSAbus Eurocard) single board computers with inter-processor communication carried out between the processor boards and associated VME memories over 2 VME and 6 VSB (VME subsystem bus) backplanes. Given both the unavailability of new processing boards which support communication over VSB, and the wish to replace the aging Exabyte-based tape system with a network-attached file server, there was a need to replace the current acquisition system.

With the large performance increase in microprocessors since the development of the original acquisition system, the new system could be considerably simplified. All previous readout functions are now accommodated by a single PowerPC-based VME processing board removing the need for an independent VSB communications bus. To reduce the cost of the system, the existing event builder and 3 of the 6 existing CES triple-port memories were reused. Data from the Gammasphere electronics is multiplexed by the event builder to three CES memories via a FERA-like bus. These are then read by the single processor over a VME backplane and subsequently processed. Data rate is limited by the block transfer rate of the VME backplane and was found to be approximately 15 Mb/s.

The acquisition system is organized as a number of coordinated tasks operating on the single-board computer under the vxWorks operating system. The three tasks involved with readout and processing are inLoop(), effLoop() and outLoop() which communicate via 5 unidirectional message queues as shown in Fig. 1. The inLoop() task is charged with reading the CES memories upon a VME interrupt that is generated when one of these memories has filled. These unprocessed data buffers are then passed to the effLoop() task where event filtering and formatting is performed. A great simplification over the previous readout system is that all experiment specific information is encapsulated in a filtering and formatting function, which specifies the acceptance criteria and data format of the event respectively. This allows one to tailor the readout to specific experimental requirements quickly and safely. The third task, outLoop() writes the processed data to a network-attached disk array and to workstations used to monitor the experiment.

Tests of the new readout system were carried out, prior to the departure of Gammasphere from LBNL, with calibration sources and was found to perform well giving results consistent with the current readout system. Following the inclusion of a graphical user interface and calibration routines, this system will be retested and implemented into Gammasphere as the primary data readout and acquisition system.

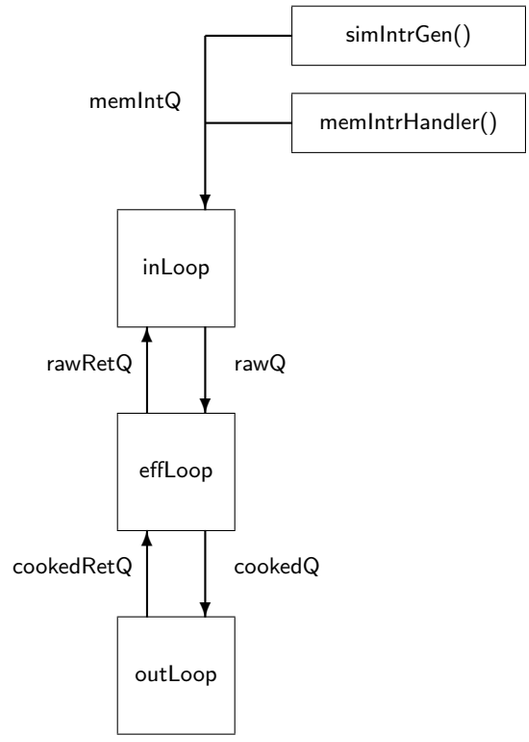

FIG. 1: Data-flow diagram showing relationships between primary acquisition tasks (square boxes) and message queues (vectors). The functions memIntrHandler() and simIntrGen() dispatch real and simulated interrupt vectors respectively.